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Analysis of
Global Oceanic Rainfall from Microwave Data

Final Report
Contract No. NAS5-23852

ANALYSIS OF
GLOBAL OCEANIC RAINFALL FROM MICROWAVE DATA

FINAL REPORT
Contract NAS5-23852

January 3, 1978

Prepared for:

Mr. John Theon, Code 911
National Aeronautics & Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Prepared by:

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16. Abstract A Global Rainfall Atlas has been prepared from Nimbus 5 ESMR data. The Atlas includes global oceanic rainfall maps based on weekly, monthly and seasonal averages, complete through the end of 1975. Similar maps for 1973 and 1974 have been studied. They reveal several previously unknown areas of enhanced rainfall and preliminary data on interannual variability of oceanic rainfall.			
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SUMMARY OF RESULTS

Nimbus 5 ESMR data on CBT Tapes for the entire year 1975 were 'cleaned
'cleaned up' (by eliminating anomalous mode and other unwanted data). The
data were then fully processed to obtain quantitative rain rate estimates,
spatially averaged over 4° of latitude by 5° longitude grid cells
over all the oceanic areas of the entire globe. The generation of global oceanic
rainfall maps on a weekly, monthly and seasonal basis was completed upto the
end of 1975.

Encouraged by the results of earlier investigation of the diurnal
variation of precipitation over the GATE area, the separation into daytime and
nighttime rain intensities of all ESMR data since the date of launch of Nimbus 5,
was initiated, by the end of FY 1977, night time rainfall data averaged over
periods of one week at a time, for 25 months (December 1972 through
December 1974), and day time rainfall data also averaged over weekly periods
for 13 months (December 1972 through December 1973) were fully processed.

The work mentioned in items 1.1 and 1.2 above involved the usage
of 54 hours of computer time in equivalent 360/75 hours (20 hours of 360/91
time and 7 hours of 360/75 time).

Analysis was made of satellite-derived oceanic rainfall maps for the
years 1973 and 1974, and this led to many important climatological results.
The following new and distinctive characteristics of global patterns were
revealed by the analysis.

- (a) In the Pacific Ocean, proceeding eastward along the Equator, the rainbelt in the Intertropical convergence zone bifurcates in the neighborhood of longitude 170° E: the upper branch proceeds eastward, maintaining itself slightly north of the Equator, whereas the lower branch runs east or southeastward, and merges with the southern Pacific rain zone (path of storms) in the vicinity of longitude 160° W.
- (b) In the Atlantic, to the southeast of South America, there is an extensive area of rainfall approximately between latitudes 25° S and 50° S and longitudes 50° W and 25° W. This rainy region does not appear on any existing map of global rainfall and is a new discovery.
- (c) A study of the zonally averaged rainfall rates in the Indian Ocean discloses two distinct rain maxima in the Tropics between latitudes 20° N and 20° S. The maximum at northern latitudes appears to grow at the expense of the maximum immediately to the south of the Equator as the monsoon advances and vice versa as it retreats.
- (d) The extent of variation of rainfall over the oceans from year to year was largely a matter of conjecture upto the present time. Analysis of satellite-derived oceanic maps shows that the ratio of the total oceanic rainfall in the year 1973 to the rainfall over the same area in 1974 is 1:07. In particular

areas or seasons, the variation is much larger. For example, in the Equatorial Pacific, the ratio of rainfall in the period December 1973 thru February 1974, to the rainfall in the period December 1972 thru February 1973 is 1:6. Investigations of anomalies of this type and their correlations are very valuable in weather as well as climatic studies.

The above results were incorporated into a paper entitled "New Features of Global Climatology Revealed by Satellite-Derived Oceanic Rainfall Maps" by M. S. V. Rao and John S. Theon, which has been accepted for publication in the December 1977 issue of the Bulletin of the American Meteorological Society.

The entire work of data processing, scientific analysis of the processed data, and preparation of a paper based on the scientific investigation briefly described above took altogether two man-years.



COPY

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January 3, 1978

Mr. John Theon, Code 911
National Aeronautics & Space Administration
Goddard Space Flight Center
Greenbelt Road
Greenbelt, Maryland 20771

Re: Contract NAS5-23852
SAS Project No. 2036

Dear Mr. Theon:

This letter is being sent to verify the following submissions
in fulfillment of Article II, Deliverable Items, of the subject contract:

<u>Item</u>	<u>Description</u>	<u>Date Sent</u>
1	Global Rainfall Atlas	9/30/77
2	Draft-Final Report	9/30/77
2	Approved-Final Report	1/3/78

If you have any questions concerning these deliverables,
please feel free to call me.

Sincerely,



Sharad K. Tak
Vice President

SKT:mkr

cc: Contracting Officer, Code 289